

Article by Alexander Graham Bell, undated

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AERONAUTICS

in like capacity for the Aeronautic Society.

The passing of our intimate friends and relatives brings home to us a more serious realization of life. It makes supreme the desire to pierce the veil of the unknown. We wonder on the one hand if life is worth living; and then we consider that we are here to live our lives, that the allotted time is short and we must improve our opportunities. And yet—

The boast of Heraldry, the pomp of Power, All that Beauty, all that Wealth e'er gave Await alike the inevitable hour; The paths of Glory lead to but the grave. tr [???

ON THE GYROSCOPIC ACTION OF PROPELLERS. By Dr. Alexander Graham Bell.

In the course of a discussion with Mr. J. A. D. McCurdy last May concerning the nature of the torque produced in an aeroplane aerodrome by the rotation of its propellers, Mr. McCurdy referred to Brennan's Mono-Rail Car System as an illustration of the powerful gyroscopic action of flywheels. This led [???] to the consideration of the gyroscopic action of propellers; and we consulted the Encyclopedia Britannica to see whether we could work out, from the description of the gyroscope there given, what would be the effect upon an aeroplane aerodrome of the gyroscopic action of its propeller, and we came to the following theoretical conclusions:

With a right-handed rotation of the propeller the machine, when steered to the left or port side, would tend to rise at the bow until the bow pointed vertically upward. When steered to the right or starboard side, the machine would tend to dive until the bow pointed vertically downwards.

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With a left-handed rotation of the propeller opposite effects would be produced; the machine tending to dive when turned to port, and tending to rise at the bow when turned to starboard.

The general conclusion reached was that both the horizontal and vertical steering of the an aerodrome with a single propeller would be seriously affected if the propeller exerted any sensible gyroscopic action.

This theoretical result has been amply verified by experiments made here July 16, 1908, with a gyrostat constructed after the plans of the late Lord Kelvin.

The gyrostat consists simply of a thin metallic case enclosing a heavy wheel which can be set in rapid rotation by means of a string coiled round one end of the axis.

In order to imitate the action of the propeller of the June Bug, the concealed wheel was given a left-handed rotation (against the hand of a watch). I then held the gyrostat in my hand with one axis pointing forward, so that, considering this end of the axis as the bow or front end of the aerodrome, the wheel represented the propeller. Then to represent the forward flight of the aerodrome I walked forward with the gyrostat in my hand. I then imitated the action of steering the aerodrome by turning to the right. Instantly the bow end of the gyrostat turned upwards with considerable force. Upon turning to the left it turned downwards. Then to represent the act of steering downwards with an aerodrome, I depressed the bow end of the gyrostat with the result that the bow tried also to move to the right or starboard side. Upon elevating the bow of the gyrostat to represent steering upwards with an aerodrome, the bow of the gyrostat was deflected to the left.

With a right-handed rotation of the wheel of the gyrostat opposite effects were produced.

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The effects were so marked as to indicate that the gyroscopic action of a rapidly rotating propeller in an aerodrome should be studied and allowed for in the steering of the apparatus. The following contains a summary of the observations made.

Right-Handed Rotation:

Steering to right sends bow down.

Steering to left sends bow up.

Steering down sends bow to left.

Steering up sends bow to right.

Left-Handed Rotation:

Steering to right sends bow up.

Steering to left sends bow down.

Steering down sends bow to right.

Steering up sends bow to left.

(From the Bulletins of the Aerial Experiment Association; by permission of the Association.)